

TI 4100.29

**FAA
ELECTROSTATIC DISCHARGE
CONTROL PROGRAM
MANUAL**

AVIATION SYSTEM STANDARDS

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CHANGE**U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION****TI 4100.29
CHANGE 01**

SUBJ: AVN ELECTROSTATIC DISCHARGE CONTROL PROGRAM MANUAL

Change 01 provides clarity for certain paragraphs and procedures regarding the Aviation System Standards Maintenance Program.

The List of Effective Pages is updated.

The Foreword is updated.

The Master Table of Contents is updated.

Chapter II, Section 2 is revised to correct ESD training requirements.

Chapter II, Section 2 is revised to add monthly inspections of ESD wrist strap testers and to clarify the components of the ESD workstation/protected area.

Chapter II, Section 3 is revised to correct typographical error, add ESD footwear and add ESD flooring.

Chapter II, Section 4 is revised to specify sensitive component packaging requirements and instructions for discarding used ESD bags and containers.

Chapter II, Section 6 is revised to add instructions for discarding used ESD bags and containers.

After inserting this change, enter your initials and the date on the Record of Changes page located at the front of the manual. File this change notice behind the manual title page.

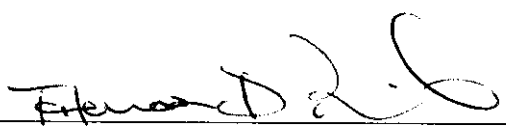
PAGE CONTROL CHART

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Aircraft Maintenance and Engineering Division, AVN-300

Date: 02/09/04

DISCLAIMER: This form is applicable to hard copies of the Electrostatic Discharge Control Program Manual (ESDCPM). It does not indicate the current change status of the electronic version of the ESDCPM. Change status is indicated in the Manuals Block of the Electronic Maintenance Library.

RECORD OF CHANGES

DIRECTIVE NO.

TI 4100.29

Keep your directives current. After filing revised pages and removing obsolete pages, initial and date the block following the change number. Request any missing changes from your central distribution point.											
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LIST OF EFFECTIVE PAGES

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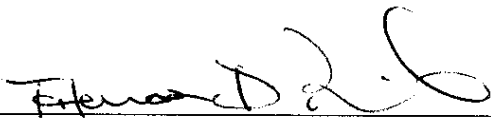
FOREWORD

*The Aircraft Maintenance and Engineering Division (AMED) is responsible for the Aviation System Standards (AVN) Electrostatic Discharge Control Program (ESDCP).

This manual establishes and describes the procedures utilized by AVN for the ESDCP.

*The ESDCP provides operational requirements for the control of Electrostatic Discharge (ESD) within the Aircraft Maintenance and Engineering Division, AVN-300. The goal is a fully implemented and integrated program that not only conforms to internal quality system requirements, but also is cost-efficient and functional.

APPROVED:



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Aircraft Maintenance and Engineering Division, AVN-300

Date: 02/09/04

AVIATION SYSTEM STANDARDS ELECTROSTATIC DISCHARGE CONTROL PROGRAM MANUAL

CHAPTER I. GENERAL MANUAL SYSTEM

1. MANUAL STRUCTURE

A. GENERAL

The Aviation System Standards' (AVN) Electrostatic Discharge Control Program Manual (ESDCPM) is issued in loose-leaf and electronic form and is structured as follows:

- (1) Record of Change - Provides space for recording insertion of revisions. (VN Form 4100-65).
- (2) Foreword - Self-explanatory.
- (3) List of Effective Pages - Provides the current manual change number, its date and a list of individual pages and their current change number.
- (4) Table of Contents - A Table of Contents, located in the front of this manual, will list the chapter and section titles and beginning page number and show change status of each page of the Table of Contents. It will also show the change status of each chapter and section.
- (5) Chapters - Sequentially numbered, beginning with Roman number I (one).
- (6) Sections - Sequentially numbered with Arabic numbers beginning with number one (1), as in I.1.
- (7) Pages - Pages are sequentially numbered. Each page number begins with the chapter number followed by a decimal (.), section number followed by a decimal and the page number. This number is located on the lower corner of each page, e.g., I.1.1.
 - (a) Date - Date of each page will be listed on the top of each page. This signifies the latest revision date for that page. The date format will be listed numerically as month/date/year, e.g., 04/17/01.
 - (b) Change Number - A number will be shown in the corner under the TI number, indicating the revision number of that page.

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CHAPTER I. GENERAL MANUAL SYSTEM

2. REVISION SYSTEM

A. GENERAL

- (1) The revision system provides methods to ensure new information can be incorporated into the approved TI manual system. The basic manual is revised on an as-needed basis using the following method:
 - (a) Routine Revisions - The routine method of revision is done by issuing page changes, as required, which contain all needed changes developed by the date of issue.
- (2) Action to correct misspelled words or to improve sentence structure will be held until a routine revision is made.

B. ROUTINE REVISIONS

- (1) Changes to the basic manual will be issued as "page changes" ready for insertion. A Transmittal page will accompany all changes issued, and is identified by a black rectangle located in the upper left hand corner with the word CHANGE contained therein. The Transmittal Page will identify the manual being changed, indicate the change number, show the effective date of the change(s), provide a synopsis of the major changes, and include a Page Control Chart to indicate the pages to be removed and/or inserted, as appropriate.
- (2) A RECORD OF CHANGE page, VN Form 4100-65, is included in the front of each manual to record the date the change was inserted into the manual. This page will provide a quick reference for determining the revision status of the specific manual.
- (3) If most of the data in a paragraph or section has been revised, an asterisk will be placed at the highest level to indicate that all the data in the section or paragraph has been revised. The asterisk will be removed at subsequent revisions so that only changes made by the current revision are indicated.

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C. REVISIONS RESPONSIBILITIES

- (1) AVN-300 is responsible for:
 - (a) Standardization of manual format.
 - (b) Control of changes for this ESDCPM.
 - (c) Printing of the manual and changes.
 - (d) Obtaining distribution of the manual and changes.
 - (e) Soliciting comments and making necessary corrections.
 - (f) Make appropriate portions of the ESDCPM available to any person performing maintenance or ground operation on AVN aircraft.
- (2) Users are responsible for:
 - (a) Forwarding suggested corrections and changes to AVN-320 for processing.
 - (b) Maintaining assigned manuals, including changes. Each person issued a copy of this manual is responsible for inserting all revisions and being familiar with its contents.
 - (c) Personnel making copies of pages in the ESDCPM or off the WEB are reminded that these copies are only valid for immediate use.

NOTE: Any copies or sections of the manual must be destroyed or disposed of after use. These copied pages or sections are not to be stored, filed or stockpiled.

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D. SUGGESTED CHANGES

Suggested manual changes and temporary revisions will be forwarded using Request for Action Form, VN 4100-170 (See GMM, TI 4100.24, Chapter/Section IV.3) through the employee's supervisor, to the Manager, AVN-320, for review and processing. All proposed changes will be reviewed for compliance with AVN policy and regulatory requirements before submittal to the approving officials. A copy of all Request for Action forms incorporated will be retained on file for a period of one year or until the next change in the same area, whichever occurs first.

E. PROCESSING CHANGES

- (1) Routine Revisions - Routine revisions to the ESDCPM will be developed from requests for changes accumulated for that period. All proposed changes will be addressed. The Quality Assurance Branch, AVN-320, is responsible for development, review, revisions, coordination, formatting revision indicators and regulatory compliance before printing and distribution of manual changes.
- (2) Table of Contents - As changes are made to the original manual, the Table of Contents is changed to include a complete list of basic, changed, deleted and blank pages in numerical sequence in the "CHG" column. The Table of Contents/List of Effective Pages contains change numbers and date following the page number for each section.

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3. MANUAL ACCESS

A. GENERAL

Access to the Electrostatic Discharge Control Program Manual, TI 4100.29 (ESDCPM) is provided through a website located at "<http://www.mmac.jccbi.gov/avn/300maint/maint.html>." Revisions to the website will be made as changes are issued.

The Program Standards Section, AVN-328, will maintain the master copy of this manual.

NOTE: Pages downloaded or printed from the website become uncontrolled and become the responsibility of the user to ensure the currency of this document.

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CHAPTER II. ELECTROSTATIC DISCHARGE CONTROL PROGRAM

1. GENERAL

A. BACKGROUND

ESD is the transfer of an electrostatic potential between bodies that are of different electrostatic potentials either by direct contact or by induction from an electrostatic field. ESD is recognized as the leading cause of electrical overstress (EOS) damage and degradation to electrical and electronic components, assemblies and equipment. An ESD event can be destructive, causing immediate catastrophic failure or degradation of operational parameters, or can cause latent defects that may not be immediately detectable but will shorten the life cycle of affected components.

B. SCOPE

This document applies to all AVN-300 personnel who perform any of the following functions relating to ESD sensitive systems, subsystems, equipment or component parts: assembly, testing, inspection, shipping, receiving, packaging, installation, operation, maintenance, repair, rework, calibration, adjustment, or supervise and manage personnel who perform any of the foregoing functions.

This manual, in conjunction with applicable equipment manufacturer manuals, will be used to ensure compliance with ESD requirements.

C. REFERENCED DOCUMENTS

- (1) ANSI/ESD-S20.20-1999 Standard - An ESD Association Standard for the Development of an Electrostatic Discharge Control Program of Electrical and Electronic Parts, Assemblies and Equipment. Provides administrative and technical requirements, as well as guidance for establishing, implementing and maintaining an ESD program.
- (2) Aviation System Standards ISO 9001 Quality Procedures, TI 4100.28, Change 01 - Appendix 5, AVN-333, Stockroom ESD Instructions (Reference IV.15).
- (3) AVN-300 Aircraft Maintenance Manuals - Maintenance manuals that provide ESD procedures specific to the avionics industry.

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CHAPTER II. ELECTROSTATIC DISCHARGE CONTROL PROGRAM

2. ESD CONTROL PROGRAM REQUIREMENTS

The ESD Control Program plan implements and verifies the program and applies to all applicable facets of the Flight Inspection Maintenance Division, AVN-300.

A. SCOPE

Personnel who remove, inspect, test, repair or install instruments and equipment containing ESD sensitive components must be aware of the possibility of ESD damage and should handle ESD components in accordance with procedures covered in this plan. Electronic components that are considered to be ESD sensitive include integrated circuits, transistors and diodes, monolithic and hybrid microelectronics, MOS capacitors, thin film resistors, and piezoelectric crystals. Any circuit or piece of equipment containing ESD sensitive components is subject to ESD damage if certain handling precautions are not observed.

B. ADMINISTRATIVE RESPONSIBILITIES

The Division Manager, Branch Managers and Section Supervisors are responsible for ensuring the ESD Control Plan is effectively followed and maintained.

An ESD Coordinator will be appointed, and the coordinator may appoint an ESD Team to assist in implementing and maintaining the ESD program.

C. TRAINING

*Personnel working with ESD sensitive material shall receive annual training and new employees will be scheduled for training during "in-processing". Training completion records will be maintained in the individual employee training files.

Minimum training shall consist of:

- (1) ESD definitions.
- (2) Protection of electronic components and assemblies from ESD damage.
- (3) Responsibility for preventing ESD damage.

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- (4) Generation of ESD.
- (5) Safety precautions.

D. COMPLIANCE VERIFICATION

- (1) Audits - AVN-300 will utilize external audits to verify the organization's compliance with the ESD Control Plan procedures. Corrective action shall be documented in the Corrective Action Report (CAR) system and used to identify weak areas in the plan and provide information required for continuous improvement.
- *(2) Inspections - The ESD Coordinator and/or ESD team members shall conduct annual inspections to certify the ESD workstation, protected areas and conduct monthly inspections to certify ESD Wrist Strap Testers. Certification labels showing the certification date and expiration date shall be posted at the workstation/protected area and on the wrist strap testers.

Workstations or protected areas shall not be used for ESD sensitive components or equipment if the certification has expired. The ESD workstation/protected area shall consist of:

- *(a) Wrist straps and connections
- *(b) Designated common grounds
- *Other components or equipment that are used may consist of:
 - *(c) Dissipative mats
 - *(d) ESD Soldering Stations
 - *(e) ESD Desoldering Tools
 - *(f) Power strips
- *(3) Documentation - A log shall be maintained by the ESD coordinator indicating the certification status of the workstation/protected areas and wrist strap testers. The ESD coordinator shall maintain wrist strap employee log records.

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3. ESD TECHNICAL REQUIREMENTS

A. WORKSTATION AND PROTECTED AREA REQUIREMENTS

Workstations and protected areas shall be established to effectively control ESD. They will include equipment to perform three critical functions: Grounding, Shielding and Neutralization.

- (1) Common Point Ground - All components of the workstation/protected area (worksurfaces, people, equipment, etc.) shall be connected to the same electrical ground point called the "Common Point Ground". This common point is defined as a "system or method for connecting two or more grounding conductors to the same electrical potential." The ESD common point ground shall be properly identified by using the AVN-300 approved Common Point Ground Symbol.
- (2) Equipment/Hard Electrical Ground Connection - The Common Point Ground shall be connected to the equipment/hard electrical ground (third or green wire) connection. Connecting the ESD control materials or equipment to equipment/hard ground brings all components of the workstation to the same electrical potential.

NOTE: Some building grounds need to be checked to ensure that there is no current looping from other nearby grounds.

Ensure that the source of current is external and not static.

- (3) Grounding Wrist Strap - Each person that handles ESD sensitive components and equipment must wear a grounding wrist strap to dissipate bodily electrostatic charges. The wrist strap must fit firmly against the skin and release quickly in case of an emergency. The wrist strap incorporates a 1-megaohm current-limiting resistor, in series with the ground cord, to protect the wearer from electrical shock hazards.

Employees must verify integrity of the wrist strap, using the wrist strap tester, before handling ESD sensitive items.

- (4) Static-Dissipative Work Surface - Conductive mats on the work bench surface or special ESD bench surfaces are designed to safely remove electrostatic charges from conductive items placed on the surface.

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- * (5) Static Dissipative Seating - Chairs used at ESD protected areas and workstations should be conductive, and if padded, should be covered with static dissipative material.
- * (6) Antistatic/Conductive Clothing - Many types of clothing generate electrostatic charges. To remove some of this buildup, workstation and protected area personnel should wear outer garments and ESD footwear that help dissipate electrostatic charges.
- * (7) Static Dissipative Flooring - ESD flooring, treated flooring, carpet, treated carpet and mats should be used in ESD protected areas to help dissipate electrostatic charges.

B. PORTABLE STATIC CONTROL WORKSTATION

A portable static control workstation provides for static-free handling of ESD sensitive components and equipment during maintenance operations at the airplane.

A typical portable workstation consists of the following items:

- (1) Grounding Wrist Strap
- (2) Static-Dissipative Work Surface
- (3) Hard/Equipment Ground Connection

C. HUMIDITY AND DUST EFFECTS ON ESD SENSITIVE COMPONENTS AND EQUIPMENT

Humidity is a factor in the control of ESD. The lower the humidity, the greater the chance of damage to ESD sensitive components and equipment. Humidity at the workstation should be maintained between 30 and 65 percent.

Repair of ESD sensitive circuit boards, including replacement of ESD components, should be performed in a dust-free environment.

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4. PACKAGING OF ESD SENSITIVE COMPONENTS AND EQUIPMENT

*All ESD sensitive components and equipment require special ESD protective packaging. All ESD sensitive components will be treated as class 1 sensitivity with 100 volt threshold. ESD protective packing requirements, unless otherwise defined by specification, shall conform to the following:

- (1) Static Shielding Packaging - All ESD sensitive components and equipment shall be packaged in approved static shielding containers/packaging. Do not place static generating materials, such as polyethylene, Styrofoam, or paper inside the container/package.

NOTE: Antistatic packaging is generally pink or blue in color. The material differs from common plastic in that an antistatic compound is incorporated into the material during the manufacturing process. This type of packaging DOES NOT provide static shielding, and is generally used to package instruction sheets, data sheets, and other non-ESD sensitive materials prior to introduction into a static-free environment.

Conductive Static Shielding packaging differs from antistatic packaging, in that it has the ability to shield devices, contained within, from external static charges.

- (2) Seal With an Appropriate Cautionary Label or Other Approved Methods - Use only the approved materials to seal the package. Do not use clips, staples, or static generating tape.
- *(3) Remove ESD Sensitive Equipment From Packaging Only at a Certified Protected Area or Workstation - Remove ESD components and equipment from protective, static-shielded containers ONLY at a certified protected area or workstation after attaching a grounding wrist strap and verifying that ESD producing items are not on the static dissipative work surface. After ESD components and equipment are removed from the static-shielded bags/containers, remove all used bags/containers from workstation before inspection or testing components and equipment.

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5. STORAGE AND TRANSIT OF ESD SENSITIVE COMPONENTS AND EQUIPMENT

Ordinary plastic containers or packing materials shall not be used when transporting ESD sensitive components. Manufacturers' recommendations will be used. The following are other requirements for ESD control:

- (1) ESD sensitive components and equipment shall be transported in conductive static-dissipative or anti-static materials.
- (2) Shipping information, instructions, and other paperwork, accompanying ESD protected packages, shall be contained in anti-static materials and attached to the outside of the package/container by ESD approved methods.
- (3) Open or damaged ESD packaging containing sensitive components and equipment are unacceptable and should be referred to the Branch ESD coordinator for resolution.

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CHAPTER II. ELECTROSTATIC DISCHARGE CONTROL PROGRAM**6. MAINTENANCE PRACTICES****A. GENERAL PRECAUTIONS FOR HANDLING ESD SENSITIVE COMPONENTS AND EQUIPMENT**

All personnel handling ESD sensitive equipment should receive instructions in the proper handling of such items. Observe the following handling rules to prevent damage to ESD components and equipment:

- (1) Keep ESD components and equipment inside ESD protective packaging until opened at a static controlled workstation or protected area.
- (2) Before unsealing ESD protective packages, place the package on the work surface of a static controlled workstation or protected area.
- (3) Do not use pressure air nozzles to remove dust from ESD sensitive printed circuit boards.
- (4) Use only approved solvents and natural bristle brushes to clean ESD sensitive equipment.
- (5) Always wear a grounding wrist strap when opening any ESD protective package.
- (6) Avoid touching circuit components or connector pins when handling ESD components or equipment.
- (7) Never place any ESD sensitive component, before or after assembly, on a nonconductive surface or in a container not specifically designed for storage of ESD devices.
- (8) Protect ESD sensitive components and equipment in ESD protective containers, with their conductive caps, and/or with pin shorting devices.
- (9) Seal all containers with an ESD protective warning label prior to shipment.
- (10) Store and transport ESD sensitive components and equipment in static shielding containers.
- (11) Place all loose ESD sensitive components and equipment into ESD protective containers before removing a grounding wrist strap.

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- (12) Keep the workstation/protected area free of any material not required to accomplish the required task.
- (13) Follow established ESD protection rules and procedures.
- (14) Use only hand tools that have conductive or static dissipative handles or grips.
- (15) Use certified workstations or protected areas.
- (16) Test equipment must be rated for use around ESD sensitive components and equipment.
- (17) Avoid exposing ESD sensitive components and equipment to large electromagnetic or electrostatic fields such as transformers or transmitting antennas.

B. REMOVAL/INSTALLATION OF ESD SENSITIVE EQUIPMENT

Observe the following procedures when removing or installing ESD sensitive equipment at the airplane or test bed:

- (1) When using test equipment, discharge all test leads to ground prior to connection to the ESD circuit under test.
- (2) Use a portable static control workstation when removing ESD circuit boards from card cages and enclosures if unable to do so in a permanent ESD workstation or protected area.
- (3) Wrist straps and connections must be verified operable by the user prior to handling ESD sensitive material.
- (4) Place removed ESD sensitive equipment on the workstation dissipative work surface before opening the static shielding container holding the replacement ESD sensitive equipment.
- *(5) All used ESD bags and containers shall be removed from workstation prior to removing dust covers and inspection of ESD sensitive equipment or components.
- *(6) Just prior to engaging a cable connector with its mating receptacle, touch the connector shell to the receptacle shell to neutralize any electrostatic charge on the connector or the installer's body.
- *(7) Maintain protective coverings on stored ESD sensitive equipment.